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Creep behaviour of shell structures, learning from failures

Supervisor: Bernard Espion (bespion@ulb.ac.be)

Co-supervisor (optional): /

Other contact persons: /

Working language: English/French

Student profile: Civil Engineering

Prerequisites/special skills (optional): interest in Construction History Research and Structural Analysis

Summary

Thin concrete shells are exposed to creep, as every concrete construction. The induced deformations can cause problems of instability for some critical cases. As a consequence, several collapses occurred in the past but information about those failures is often missing. The master thesis consists firstly in collecting information about problems related to creep behaviour of thin concrete shells. The survey of the collapses and the interpretations of the failures will lead afterwards to the understanding of the consequences of the creep phenomenon. Secondly, the necessity of taking into account these deformations in the design will be assessed and studied in details. Investigation on the stability level of the thin shell structure is also part of the work.

References

Schnobrich W.C., Reflections on the behaviour of reinforced concrete shells, *Engineering Structures*, Volume 13, Issue 2, April 1991, 199-210.



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A history of natural draft cooling towers

Supervisor: Bernard Espion (bespion@ulb.ac.be)

Co-supervisor (optional): /

Other contact persons: /

Working language: English/French

Student profile: Civil Engineering

Prerequisites/special skills (optional): interest in Construction History Research and Structural Analysis; maybe useful to be able to read a bit of German.

Summary

Natural draft cooling towers have been built for nearly 100 years and constitute a particular class and application of thin concrete shells. Purpose of the thesis is to perform a bibliographical research that should produce a detailed historical analysis of the developments of such shells, and the state-of-the-art in the design of such structures.

The company Hamon Sobelco (Drogenbos) is a worldwide known specialist designer of such kind of structures.

References

Contributions of André Paduart to the art of thin concrete shell vaulting

B. ESPION, P. HALLEUX, J. SCHIFFMANN

1st International Congress on *Construction History*, Madrid, 20-24/1/2003. Publication dans les Proceedings (S. HUERTA, editor), Instituto Juan de Herrera, Escuela Técnica Superior de Arquitectura Madrid, Volume 2, pp. 829-838.

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A history of thin concrete shells applied to airplane hangars

Supervisor: Bernard Espion (bespion@ulb.ac.be)

Co-supervisor (optional): /

Other contact persons: /

Working language: English/French

Student profile: Civil Engineering or Architectural Engineering

Prerequisites/special skills (optional): interest in Construction History Research and Structural Analysis; ability to read French, German, English; speaking Dutch may be useful.

Summary

From the 1920's to the 1940's, the need to construct aircraft hangars was an important stimulus for the development of thin concrete shell construction. Purpose of the thesis is to perform a bibliographical research that should produce a detailed historical analysis of the developments of such shells. A particular attention will be devoted to aircraft hangars built in Belgium at the beginning of the 1950s by the SETRA company.

References

Contributions of André Paduart to the art of thin concrete shell vaulting

B. ESPION, P. HALLEUX, J. SCHIFFMANN

1st International Congress on *Construction History*, Madrid, 20-24/1/2003. Publication dans les Proceedings (S. HUERTA, editor), Instituto Juan de Herrera, Escuela Técnica Superior de Arquitectura Madrid, Volume 2, pp. 829-838.

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Creep and shrinkage of concretes made with CEM-X cements

Supervisor: Bernard Espion (bespion@ulb.ac.be)

Co-supervisor (optional): /

Other contact persons: /

Working language: English/French (necessity to read English)

Student profile: Civil Engineering or architectural engineering

Prerequisites/special skills (optional):

Summary

Creep and shrinkage tests on concretes (six types) made with ternary cements have been performed these last two years in the Laboratory of Civil Engineering at the ULB. Ternary cements are cements consisting of Portland Clinker + Slag + Calcareous filler. They have been developed recently in order to offer cements that are more respectful of the environment than classical CEM I cements, but are not yet normalized (therefore CEM-X like Xperimental). The data base of creep and shrinkage measurements made at the ULB are truly unique and need to be analysed and modelled (e.g. compared with various prediction models).

References



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Shear tests on rc slabs submitted to bending and tension normal force

Supervisor: Bernard Espion (bespion@ulb.ac.be)

Co-supervisor (optional): /

Other contact persons: /

Working language: English/French (necessity to read English)

Student profile: Civil Engineering

Prerequisites/special skills (optional): this subject (field: structural concrete) is proposed for two students working together

Summary

Slabs in RC submitted to bending and tensile normal force are met as decks in bowstring bridges. For practical reasons, it would be interesting to get rid of the placement of transverse (shear) reinforcement in such structures. But the case of evaluating the shear strength of slabs or beam-like structural elements submitted to bending and tensile normal force and without shear reinforcement is not explicitly handled in the EC2. An explanatory thesis on this subject was performed at the ULB 2010-2011. Its purpose was to conceive an experimental program to provide some data for benchmarking structural models. Three large structural test pieces (6m long) have been casted and are waiting to be tested. Purpose of the thesis will be the execution of the experimental program (at the autumn) and the analysis and modeling of the results. Modeling tools will be the theory of plasticity and possibly non linear FE modeling.

References

Master thesis by Ms ZHU, 2011.

Fib bulletins